BNL-95014-2011-AB

UNDERSTANDING UNCERTAINTIES IN CURRENT CLOUD RETRIEVALS FROM ARM GROUND-BASED MEASUREMENTS

Chuanfeng Zhao, Shaocheng Xie, Stephen Klein, and Renata McCoy, *Lawrence Livermore National Laboratory*
Jennifer Comstock and Sally McFarlane, *Pacific Northwest National Laboratory*
Min Deng and Zhien Wang, *University of Wyoming*
Maureen Dunn, Michael Jensen, and Dong Huang, *Brookhaven National Laboratory*
Robin Hogan, *University of Reading*
Gerald Mace, *University of Utah*
Matthew Shupe, *University of Colorado*
David Turner, *NOAA*

For presentation at
The Second Science Team Meeting of the
Atmospheric System Research (ASR) Program,
San Antonio, TX
March 28-April 1, 2011

Environmental Sciences Department/Atmospheric Sciences Division
Brookhaven National Laboratory

U.S. Department of Energy
Office of Science

ABSTRACT

Accurate observations of cloud microphysics are critical to improve the representation of clouds in current climate models. However, large discrepancies are found in current cloud retrieval products. This poses a severe restriction in cloud modeling studies. Understanding the discrepancies is an important step to address the uncertainties in cloud retrievals. In this study, an in-depth analysis of seven existing ARM ground-based cloud retrievals is carried out. High-level ice clouds and boundary layer stratus clouds, which are the focus of most current retrievals, are specifically studied. Differences in the algorithm complexity and assumptions of cloud retrievals, the data used, and the cloud retrieval constraints are analyzed to understand their potential impacts on the retrieved products. It shows that the large discrepancies between different cloud retrievals, both in the retrieved cloud properties and the relationships between different cloud properties, can be partly expected from the differences in the retrieval techniques, like the algorithm parameters and the assumptions of particle-size distributions and ice crystal habits. The impact of input data used in the retrievals, such as cloud boundaries, cloud phase, and hydrometer classifications, is also an important contributor to the large discrepancies of cloud properties between different retrieval products. It indicates the need of improving accuracy and consistency in the input measurements for current retrievals. The impact of cloud retrieval constraints, such as MWR liquid water path, is also briefly described. A statistical cluster analysis technique is used to further demonstrate the systematic discrepancies between different retrievals.

NOTICE: This manuscript has been authored by employees of Brookhaven Science Associates, LLC under Contract No. DE-AC02-98CH10886 with the U.S. Department of Energy. The publisher by accepting the manuscript for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this manuscript, or allow others to do so, for United States Government purposes.